ANNUAL REPORT FOR PROJECT 8CA74539:* SIMULATION OF TREE AND STAND GROWTH RESPONSES FOLLOWING THINNING

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During the summer of 1988, 150 study trees referred to as subject trees were located on Latour State Forest. These trees are codominants that range from 66-115' in height and whose boles form equilateral or nearly equilateral triangles with two other codominants. They will be used to determine the leaf surface area (LSA) that codominants of a given height are expected to have when they are separated by different distances. The leaf biomass will be collected from the vertical wedge of each subject tree's crown that is bounded by the angle formed by lines connecting its bole with those of the other two codominants in the triangle (Fig. 1). The leaf biomass will be dried, weighed, and converted to LSA on the basis of a ratio of LSA to leaf biomass determined for each tree. Then, the LSA from each wedge will be converted to the LSA for a whole tree with a given spacing on the basis of the number of degrees in the angle bounding the wedge and the orientation of the wedge. The complete guidelines used in selecting these trees are given in the Appendix.

The specific breakdown of trees into height classes is as follows:

Height Class	Number of Trees
66-75	8
76-85	27
86-95	72
96-105	24
106-115	19
TOTAL	150

* Study funded by California Department of Forestry and Fire Protection

After the 150 trees were located, the 72 trees in the 86-95' height class were climbed and all branches contributing LSA to the vertical wedge were identified. Each branch was labelled according to the percent of the branch LSA that fell within the vertical crown wedge and the whorl to which the branch belonged. Nodal and internodal branches were identified. Internodal branches are treated as part of the same whorl as nodal branches growing out of the above node since many of them are the same age as those nodal branches.

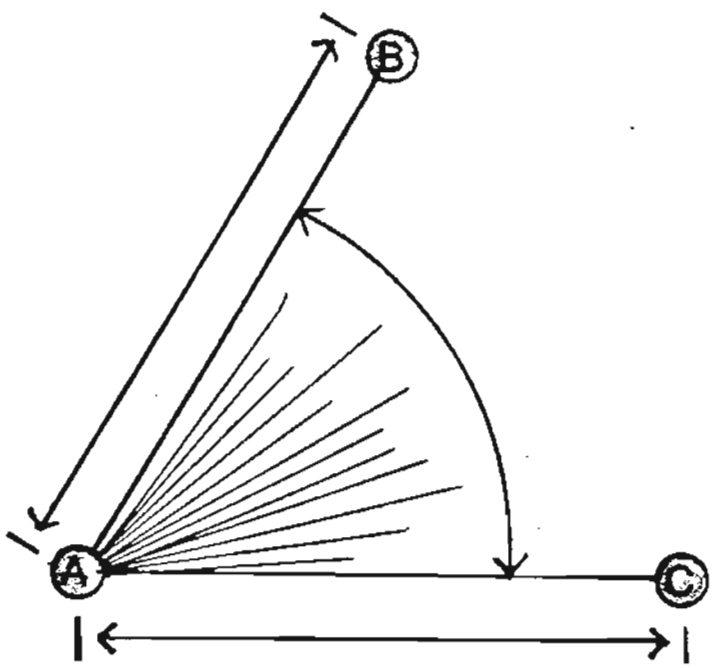

Figure 1. Planar view of subject tree A's crown wedge in the angle formed by the lines connecting trees A and B and trees A and C. The circles represent cross-sections through the tree boles; the arc defines the limits of the vertical crown wedge; and the short lines radiating from the bole of tree A represent branches in its vertical crown wedge.

APPENDIX: GUIDELINES USED FOR SELECTING SUBJECT TREES

1. The distances between a subject tree and each of the two other codominants cannot differ by more than .3 to .6 meters. When they do, the vertical crown wedge of a potential subject tree is usually skewed toward the codominant that is further away. Then, the wedge will not have the pointed (A, Fig. 2) or rounded (B, Fig. 2) shape characteristic of equally spaced trees whose growing spaces (GSs) are hexagonally shaped and can be viewed as six equilateral triangles each of which faces an adjacent tree or as six trapeziums each of which faces a pair of adjacent trees (Fig. 3). The vertical crown wedge of a subject tree is analogous to one of the trapeziums making up the hexagonal GSs trees have when equally spaced.

2. The distance between the other two codominants cannot differ greatly from the distance(s) between them and the potential subject tree. When it does, the number of degrees in the vertical crown wedge will be greater or less than the 60^0 included in the trapeziums making up the hexagonal GS of equally spaced trees. Thus, the number of degrees in the vertical crown wedge is used to control the range of acceptable distances between the other two codominats. A potential subject tree is rejected if the angle in its vertical crown wedge is $<45^0$ or $>80^0$.

3. The three trees must all share equally the triangular area formed by their boles. The branches from one or two of the trees cannot dominate the area.

4. Codominant trees located oppposite the sides of the triangle formed by the three trees should extend the spacing pattern of the group so that it will resemble, as much as possible, the pattern that exists when all trees are equally spaced (Fig. 4). This requirement is much looser, but trees certainly cannot be so close to the side of the triangle that their branches enter it nor should such trees be entirely absent. Between these extremes, considerable variation is tolerated. Subject trees are only rejected when two or more incorrect spacings err substantially in the same direction, particularly when the spacing in the group is relatively narrow (e.g., 1/6 of the height of the trees in the group). For example, when viewing

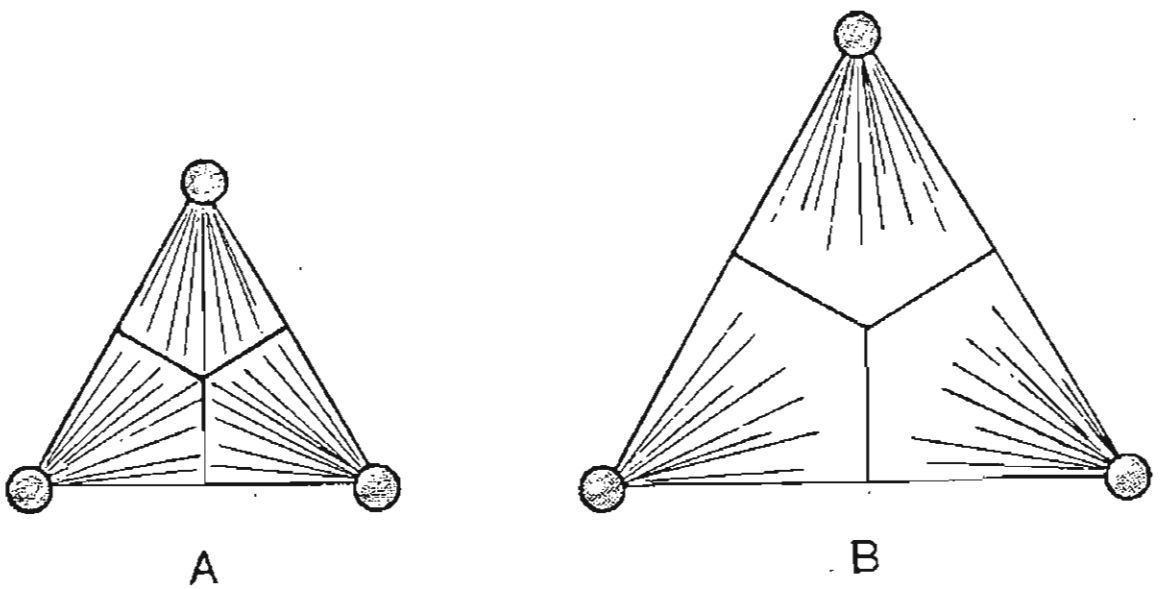

Figure 2. A: The vertical crown wedge of a subject tree will be pointed when trees are close enough for their branches to touch. Based on the geometry of a hexagon, the branches in the center of a wedge should be 1.155 times longer. Their growth is not impeded by branches from adjacent trees as early as branches along the sides of the wedge. B: The vertical crown wedge of a subject tree will be rounded when trees are not close enough for their branches to touch. In this case, all the branches in a wedge can potentially be the same length because their growth has not been impeded by branches from adjacent trees.

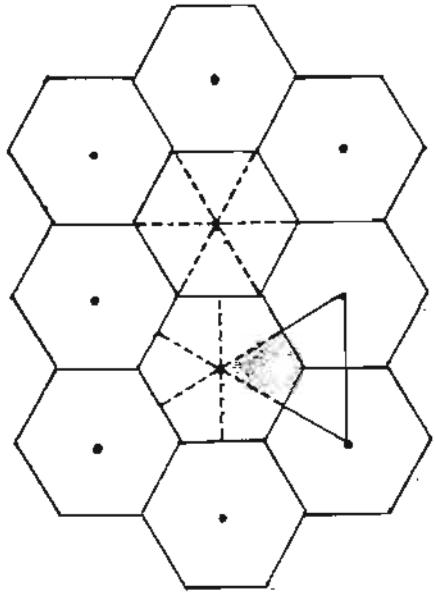

Figure 3. When trees are equidistant, they are surrounded by six other trees, their growing spaces are hexagonal in shape, and these growing spaces can be viewed as a composite of six equilateral triangles each of which faces an adjacent tree or six trapeziums each of which faces a pair of adjacent trees. The three trees joined in the large triangle are equivalent to those in the three tree groups located in natural stands. Thus, a subject tree's vertical crown wedge (shaded area) constitutes one of the trapeziums making up a tree's hexagonal growing space.

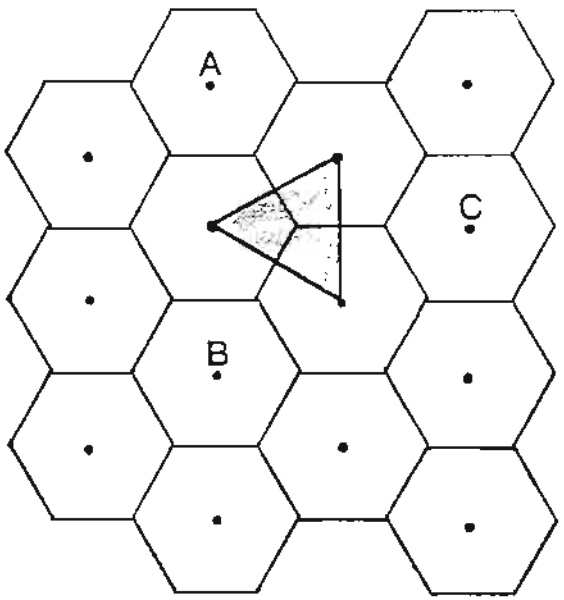

Figure 4. Trees opposite the sides of the triangle that is equivalent to the three tree groups in natural stands should be positioned as close as possible to where trees A, B, and C are positioned in a stand of equally spaced trees.

a potential subject tree as the apex of a triangle, the lines connecting it to the two other codominants as legs of the triangle, and a line connecting the two other codominants as the base of the triangle, it would be rejected if the distance between the trees forming the base is less than the distance between trees forming the legs and the tree opposite the base is considerably closer to the base than the distance between the trees forming the legs (Fig. 5).

5. Intermediate trees cannot be present within the triangle formed by the three tree group and supressed trees can only be present within the triangle if their crowns have not affected the development of the codominants' crowns.

6. Any affect that currently dead trees had on the development of the crowns of the three trees in the group cannot be apparent now.

When all these restrictions are satisfied and all three trees in a group are equidistant or within one foot or less of the same distance from each other, vertical crown wedges from all three trees can usually be used.

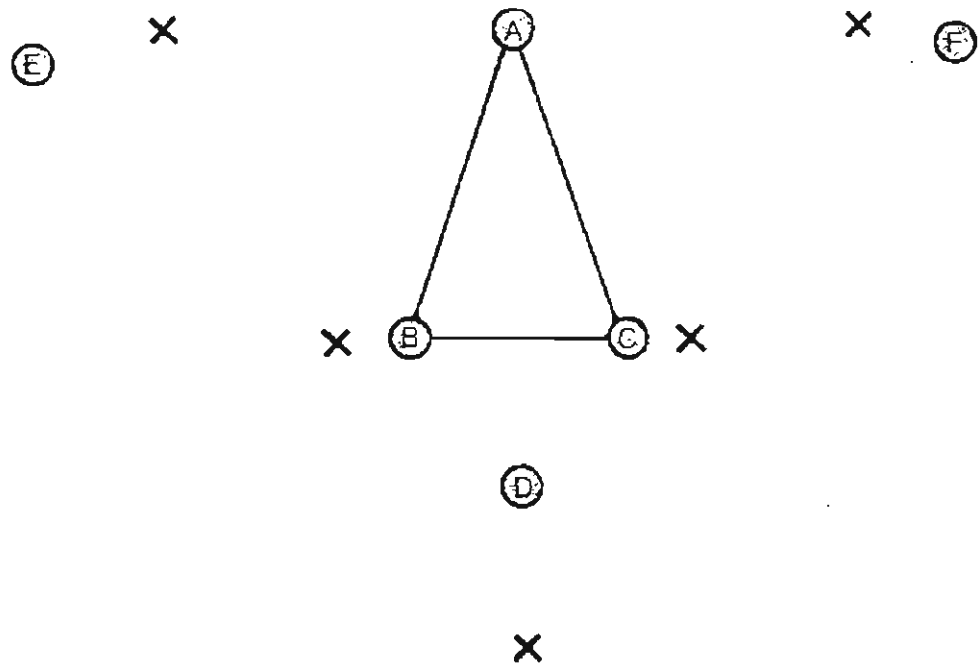

Figure 5. A hypothetical distribution of codominants (circles) that would require the rejection of potential subject tree A because two spacings err substantially in the same direction. Trees B and C are too close to each other and tree D is too close to the base of the triangle formed by trees B and C. Xs indicate where trees B, C, D, E, and F would be located in a stand of equallly spaced trees.